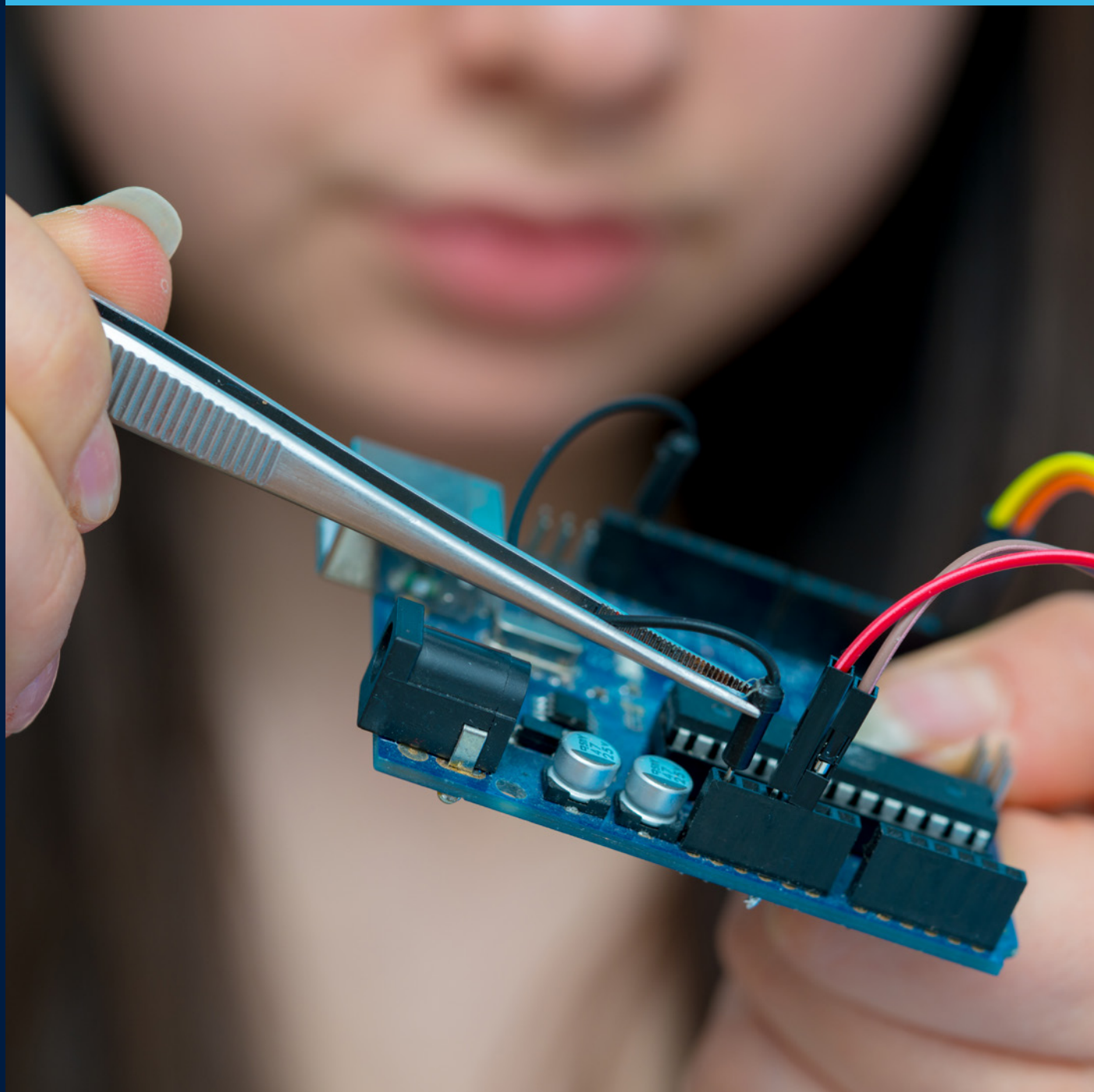
Expansion boards for intelligent power switches



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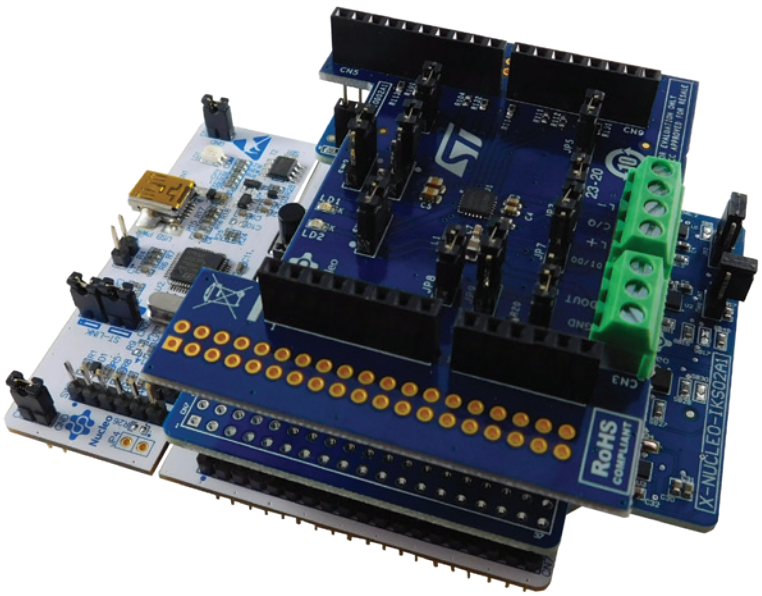


Intelligent power switches (IPS) represent a cornerstone of factory automation. ST offers an extensive range of ICs designed for many different industrial load management applications, including PLCs, remote I/O modules, actuators, and IO-Link based field devices. Some IPS have been developed with direct input from customers to ensure optimal performance.

For each IPS listed in this document, there is an associated X-NUCLEO expansion board for engineers and designers to evaluate ST IPS products and develop their factory automation applications. This environment provides a comprehensive entry point for developers familiar with the STM32 open development environment (STM32ODE), offering a selection of hardware, firmware, and software tailored to application requirements.

While ST offers various evaluation platforms, including reference designs and system evaluation boards, this brochure focuses on X-NUCLEO expansion boards, with indications of possible combinations with other boards to help accelerate the development of complete factory automation subsystems.

IPS portfolio

All the IPS (including IO-Link) ICs listed in this section have an associated expansion board belonging to the STM32ODE program for evaluation purposes.

Part number (RPN)	Output channels	Output current/channel (I_{nom}) (A)	Package	Comments	Expansion board
IPS161HF	1	0.5	PowerSSO12	Open load diagnostics	X-NUCLEO-OUT10A1
IPS1025H	1	2	PowerSSO-24	Smart load management	X-NUCLEO-OUT05A1
IPS1025HF	1	2	PowerSSO-24	Smart load management	X-NUCLEO-OUT15A1
IPS160HF	1	2	PowerSSO12	Open load diagnostics	X-NUCLEO-OUT08A1
IPS1025H-32	1	5	PowerSSO-24	Smart load management	X-NUCLEO-OUT06A1, X-NUCLEO-ISO1A1*
IPS2050H	2	2	PowerSSO-24	Smart load management	X-NUCLEO-OUT03A1
IPS2050H	2	2	QFN48L (8x6 mm)	Smart load management	P-NUCLEO-IOD3A1
IPS2050H-32	2	5	PowerSSO-24	Smart load management	X-NUCLEO-OUT04A1
IPS2050H-32	2	5	PowerSSO-24	Smart load management	P-NUCLEO-IOD04A1
IPS4140HQ*	4	0.5	QFN48L (8x6 mm)	Per channel diagnostics	X-NUCLEO-DO40A1*
IPS4140HQ-1	4	1	QFN48L (8x6 mm)	Per channel diagnostics	X-NUCLEO-DO41A1*
VNI8200XP	8	0.5	PowerSSO-36	LED matrix driver, DC-DC, SPI, per channel diagnostics	X-NUCLEO-PLC01A1
IPS8160HQ	8	0.5	QFN48L (8x6 mm)	Parallel interface	X-NUCLEO-OUT09A1
IPS8200HQ	8	0.5	QFN48L (8x6 mm)	LED matrix driver, DC-DC, SPI, per channel diagnostics	X-NUCLEO-OUT16A1
IPS8160HQ-1	8	1	QFN48L (8x6 mm)	Parallel interface	X-NUCLEO-OUT19A1
IPS8200HQ-1	8	1	QFN48L (8x6 mm)	LED matrix driver, DC-DC, SPI, per channel diagnostics	X-NUCLEO-OUT17A1
ISO8200AQ	8	0.5	QFN (9x11 mm)	Isolated, SPI, per channel diagnostics	X-NUCLEO-OUT02A1
ISO8200BQ	8	0.5	QFN (9x11 mm)	Isolated, parallel interface	X-NUCLEO-OUT01A2
ISO808	8	0.5	POWER-SO36	Isolated, parallel interface	X-NUCLEO-OUT11A1
ISO808A	8	0.5	POWER-SO36	Isolated, SPI	X-NUCLEO-OUT12A1
ISO808-1	8	1	POWER-SO36	Isolated, parallel interface	X-NUCLEO-OUT13A1
ISO808A-1	8	1	POWER-SO36	Isolated, SPI	X-NUCLEO-OUT14A1
IPS4260LM	4	0.5	HTSSOP-20	Adjustable Iout, open load/ per channel diag and catch diode	X-NUCLEO-OUT07A1

IO-Link transceivers

Part number (RPN)	Role	Package	Comments	Expansion board
L6360	Master	VFQFPN 26L (3.5x5x1 mm)	STM32 Nucleo pack for IO-Link master, protocol v.1.1 (PHY and stack)	P-NUCLEO-IOM01M1
L6362A	Device	VFDFPN 12L (3x3x0.9 mm)	STM32 Nucleo pack for IO-Link device, with IPS2050H IPS and STM32L073	P-NUCLEO-IOD03A1
L6364	Device	QFN 20L (4x4 mm)	IO-Link device expansion board, protocol v.1.1 (PHY and stack)	X-NUCLEO-IOD02A1
			STM32 Nucleo pack for IO-Link device, with industrial sensors and STM32L4	P-NUCLEO-IOD02A1
			STM32 Nucleo pack for IO-Link device, with IPS2050-32 IPS and STM32L073	P-NUCLEO-IOD04A1

Highlighted products

IPS8160HQ is a 0.7 A per channel high-side driver. This 8-channel intelligent power switch is suitable for applications in the IEC 61131 domain and can drive any kind of load (inductive, resistive, or capacitive) with one side grounded.

Active current limitation combined with thermal shutdown and automatic restart protect the devices against overload of any of the 8 channels independently (the nonoverloaded channels continue to operate normally).

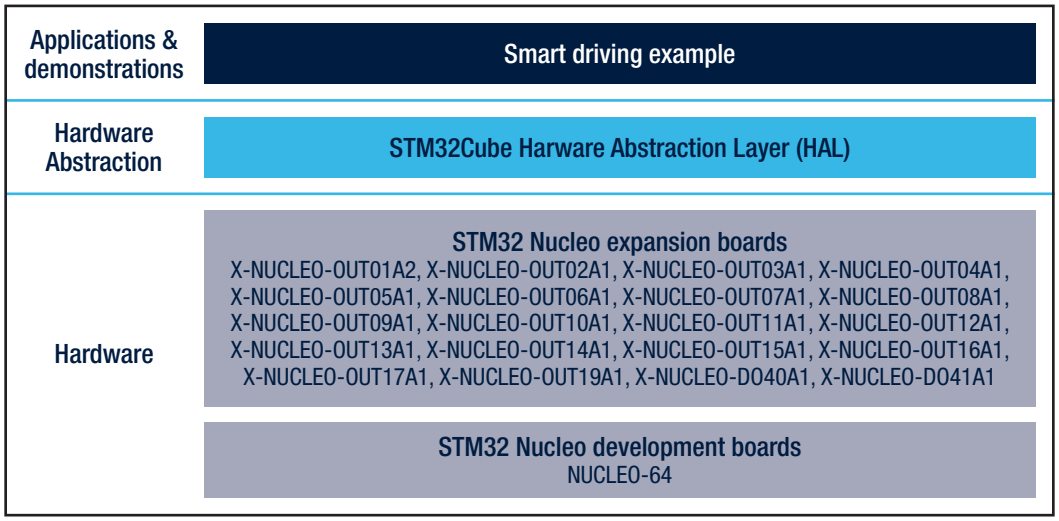
ISO808A-1 is a galvanically isolated 8-channel driver featuring a low supply current. It contains 2 independent galvanically isolated voltage domains (V_{CC} and V_{DD} for the process and control logic stages, respectively). These ICs are intended for driving any kind of load with one side connected to ground. The ISO808AQ-1 device has an SPI interface in the logic stage, with a process side operating current of 1 A per channel. All the ICs in the family feature fast demagnetization of inductive loads, low R_{DSON}, and comprehensive protections and diagnostic features.

Our collection of expansion boards

Our portfolio of expansion boards leverages the STM32ODE standardized software framework **X-CUBE-IPS**.

The X-CUBE-IPS expansion software package for STM32Cube runs on STM32 MCUs and includes drivers to control industrial intelligent power switches (IPS) mounted on various expansion boards.

With version V3.0.0 of the X-CUBE-IPS software package, expansion boards can now be connected to any 64-pin Nucleo development board, including NUCLEO-F401RE and NUCLEO-G431RB.

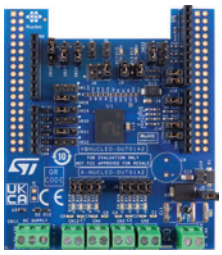


It is possible to build systems with multiple boards stacked to evaluate multichannel digital output modules, even with different output current capabilities.

The software included in the package can be used in three integrated development environments (IDEs): IAR, Keil®, and STM32CubeIDE.

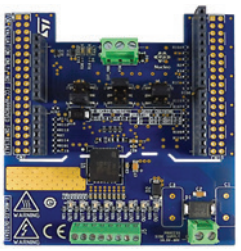
Find a comprehensive overview of the STM32 Nucleo IPS expansion boards below:

The **X-NUCLEO-OUT01A2** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the ISO8200BQ octal high-side smart power solid state relay, with embedded galvanic isolation, in a digital output module connected to 0.7 A industrial loads.

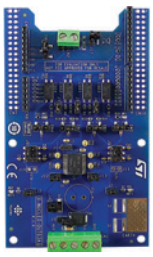


The **X-NUCLEO-OUT02A1** industrial digital output expansion board is based on the ISO8200AQ galvanically isolated octal high-side smart power solid state-relay.

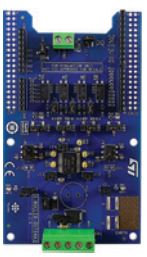
This expansion board will be included in version 3.1.0 of the X-CUBE-IPS software package.



The **X-NUCLEO-OUT03A1** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the IPS2050H (dual-high-side smart power solid-state relay) in a digital output module connected to 2.5 A (max.) industrial loads.



The **X-NUCLEO-OUT04A1** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the IPS2050H-32 (dual-high-side smart power solid-state relay) in a digital output module connected to 5.7 A (max.) industrial loads.

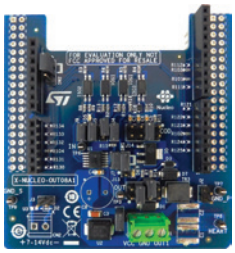


The **X-NUCLEO-OUT05A1** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the IPS1025H single high-side smart power solid state relay, in a digital output module connected to 2.5 A industrial loads.

The **X-NUCLEO-OUT06A1** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the IPS1025H-32 single high-side smart power solid state relay, in a digital output module connected to 5.7 A industrial loads.

The **X-NUCLEO-OUT07A1** industrial digital output expansion board is designed for the evaluation of the driving and diagnostic capabilities of the IPS4260LM quad low-side smart power solid state relay, in a digital output module connected to 0.5 A industrial loads.

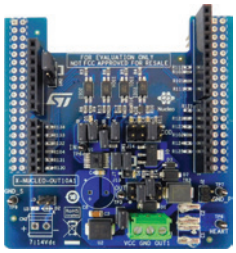
The **X-NUCLEO-OUT08A1** industrial digital output expansion board is designed for 2 A (typ.) digital output modules, featuring the safe driving and smart diagnostic capabilities of the IPS160HF single high-side switch.



X-NUCLEO-OUT09A1

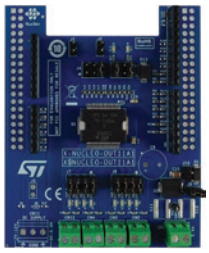
Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS8160HQ octal high-side smart power solid state relay, in a digital output module connected to 0.7 A industrial loads.

X-NUCLEO-OUT10A1



Industrial digital output expansion board for the development of 0.5 A (typ.) digital output modules, letting you easily evaluate the IPS161HF driving and diagnostic capabilities with industrial loads.

X-NUCLEO-OUT11A1

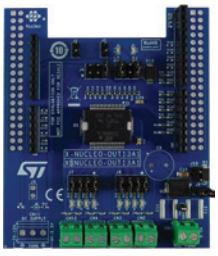


Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the ISO808 octal high-side smart power solid state relay, with embedded galvanic isolation, in a digital output module connected to 0.7 A industrial loads.

X-NUCLEO-OUT12A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the ISO808A octal high-side smart power solid state relay, with embedded galvanic isolation and 20 MHz SPI control interface, in a digital output module connected to 0.7 A industrial loads.

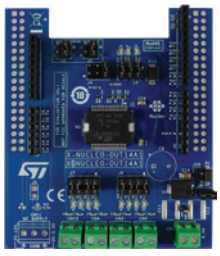
X-NUCLEO-OUT13A1



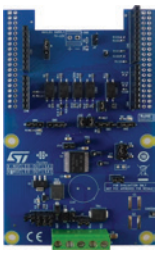
Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the ISO808-1 octal high-side smart power solid state relay, with embedded galvanic isolation, in a digital output module connected to 1.0 A industrial loads.

X-NUCLEO-OUT14A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the ISO808A-1 octal high-side smart power solid state relay, with embedded galvanic isolation and 20 MHz SPI control interface, in a digital output module connected to 1.0 A industrial loads.



X-NUCLEO-OUT15A1



Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS1025HF single high-side, smart power, solid-state relay in a digital output module connected to 2.5 A industrial loads.

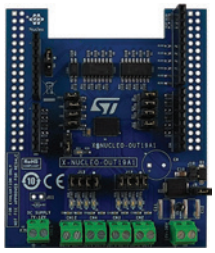
X-NUCLEO-OUT16A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS8200HQ octal high-side smart power solid state relay, in a digital output module connected to 0.7 A industrial loads.

X-NUCLEO-OUT17A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS8200HQ-1 octal high-side, smart power, solid-state relay in a digital output module connected to 1.0 A industrial loads.

X-NUCLEO-OUT19A1



Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS8160HQ-1 octal high-side smart power solid-state relay, in a digital output module connected to 1 A industrial loads.

X-NUCLEO-DO40A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS4140HQ quad high-side smart power solid-state relay, in a digital output module connected to ≤0.6 A industrial loads.

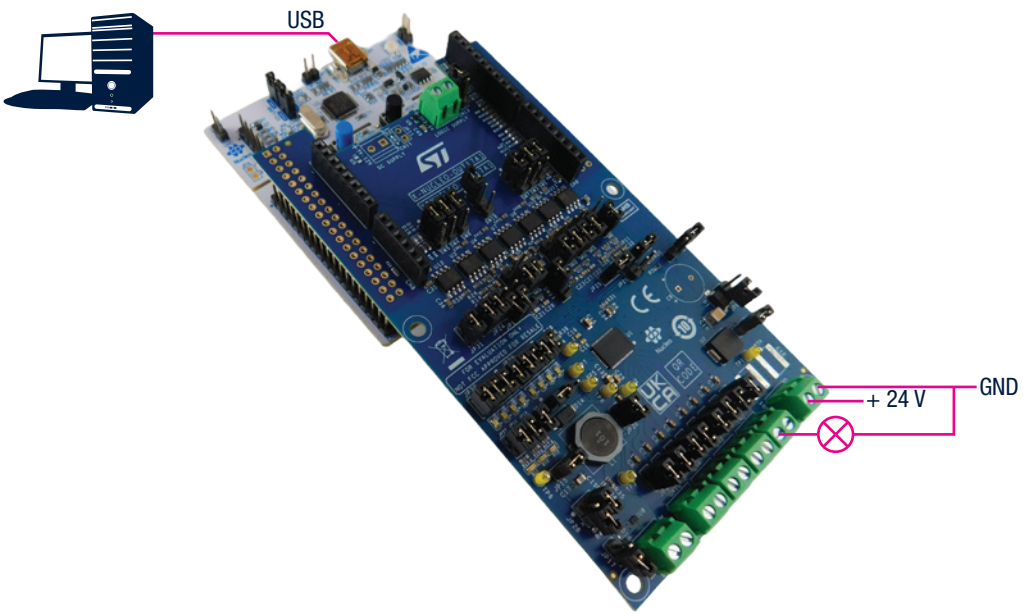
X-NUCLEO-DO41A1

Industrial digital output expansion board for the evaluation of the driving and diagnostic capabilities of the IPS4140HQ-1 quad high-side smart power solid-state relay, in a digital output module connected to ≤1 A industrial loads.

Another relevant software resource from the STM32ODE program is the **X-CUBE-OUT1** expansion software with drivers for the ISO8200BQ (running on the X-NUCLEO-OUT01A2 expansion board connected to a NUCLEO-F103RB, NUCLEO-F302R8, or NUCLEO-F401RE development board).

Application example

Figured below is the X- NUCLEO-OUT17A1 coupled with the NUCLEO-F401RE board via the Arduino connectors.



The system requires:

- a Type A to mini-B USB cable to connect your Windows 7 (or above) PC to the STM32 Nucleo board (NUCLEO-F401RE or NUCLEO-G431RB)
- the PC must have the X-CUBE-IPS software package installed

Follow these steps to set up the system:

1. Plug the X-NUCLEO-OUT17A1 onto the STM32 Nucleo via the Arduino® UNO R3 connector pins.
2. Program the STM32 Nucleo board with an appropriate .bin downloaded from the relevant project folder (see expansion board user manual).
3. Supply the expansion board as shown in the figure above picture and connect the load or loads to one of the 8 output channels (one side must be grounded).
4. Reset the MCU by pushing the black button on the STM32 Nucleo board. The blue button beside it allows you to choose between the examples provided in the default firmware package.

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